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International Competition and Industrial Performance: Allocative Efficiency, Productive Efficiency, and Turbulence

by John R. Baldwin and Richard E. Caves

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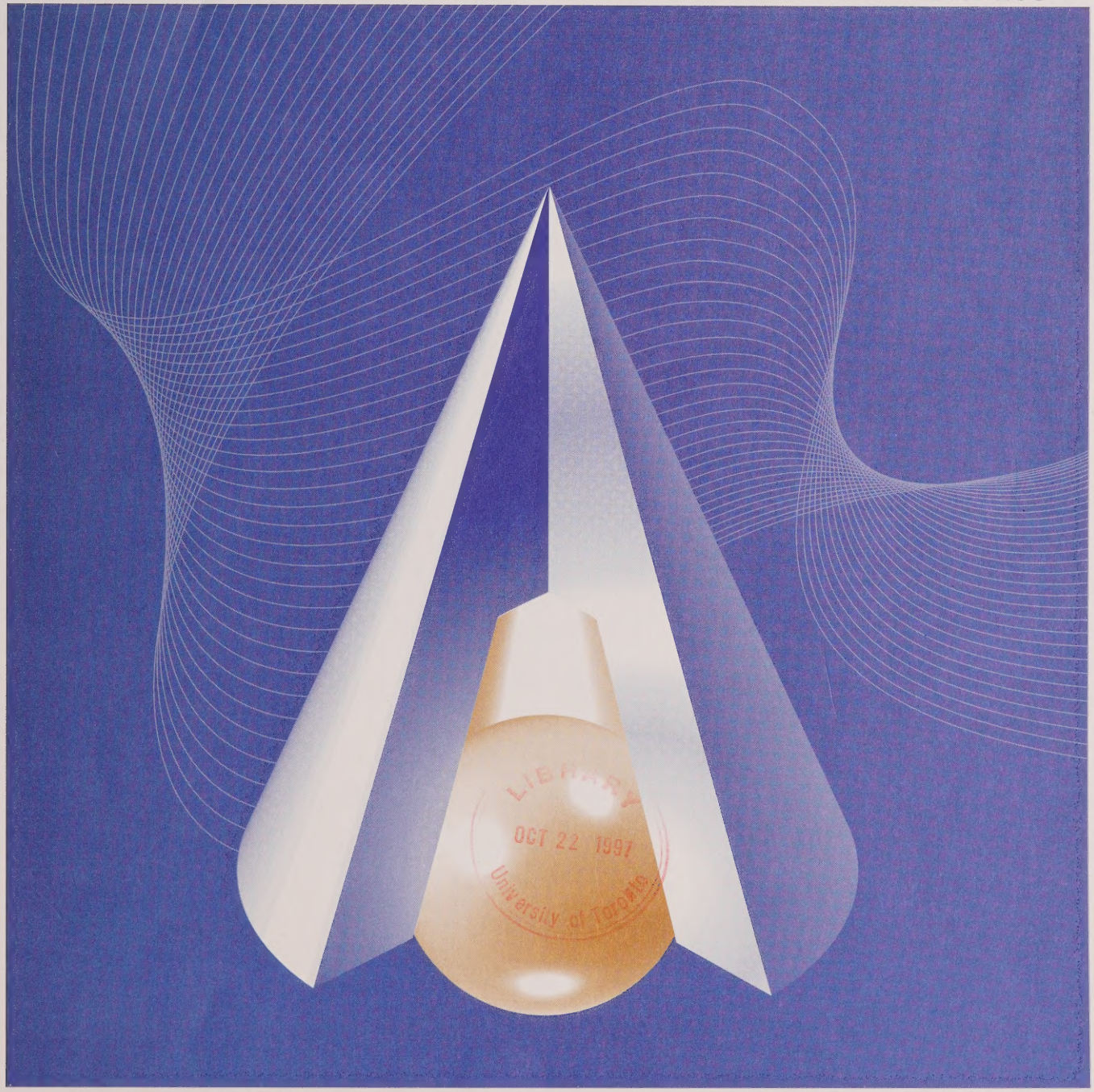

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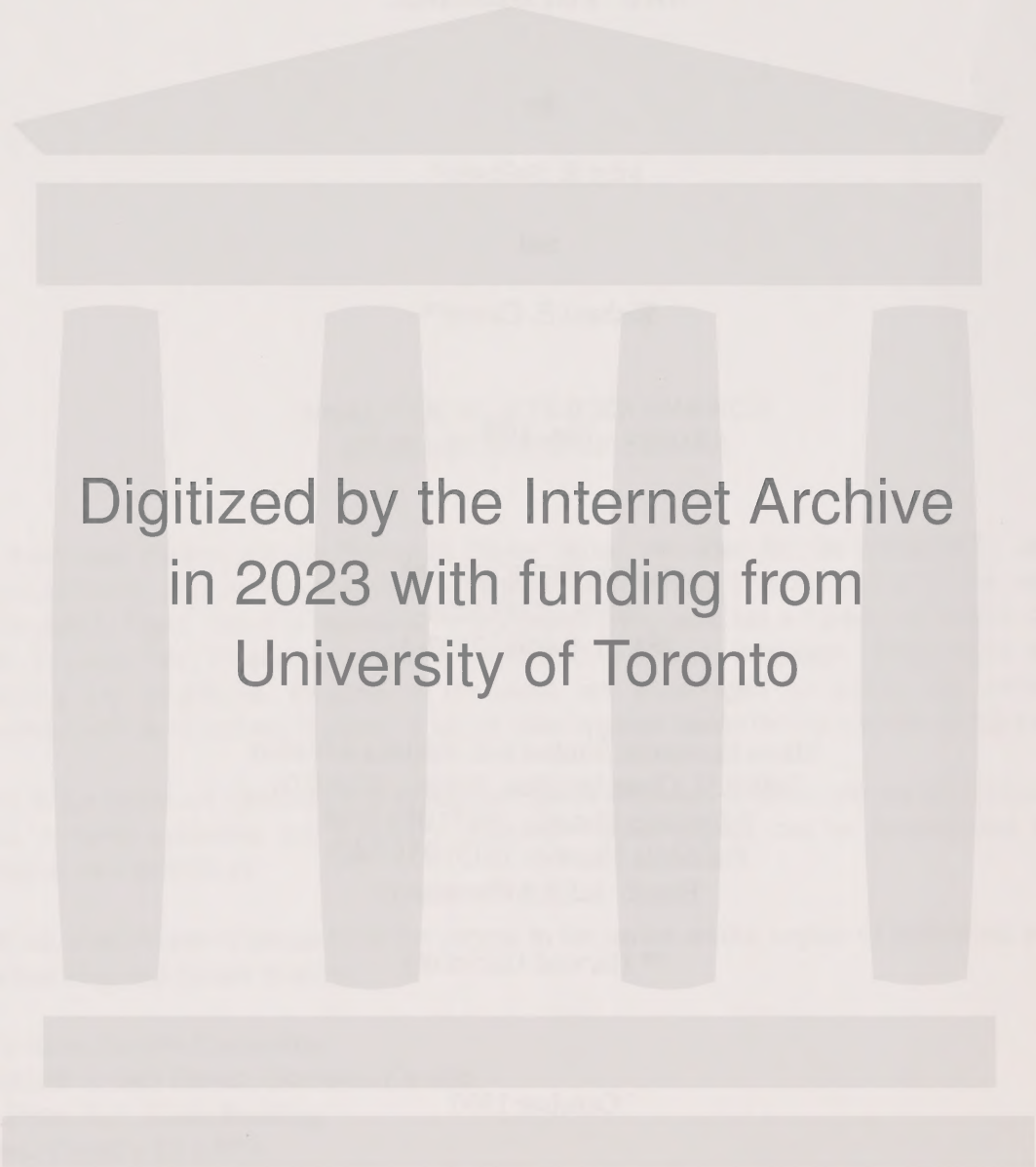

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Abstract

Trade exerts generally favourable effects on the performance of domestic manufacturing industries in the dimensions of allocative and productive efficiency. We review theory and recent evidence on these linkages and also explore a third effect on the turbulence of competitive conditions and the turnover of business units. Calculations using primary census records for Canada over 1973-1992 indicate, with time and industry effect controlled, market-share turnover, entry, exit, and mergers all increase with trade exposure. The effect is tied to market structures of differentiated products but broad international disturbances (North American Free Trade Area) also have significant effects. The normative significance of turbulence is mixed but has important positive components.

Keywords: Trade liberalization; import competition; turnover; entry; exit; mergers; acquisitions; North American Free Trade Agreement.

Introduction

The year 1846 saw the repeal of the Corn Laws, which imposed a variable levy designed to support the domestic price of grain whenever the world price fell below 72 shillings per quarter. Although Britain once again embraced a variable levy on grain by acceding to the European Union's Common Agricultural Policy, the 1846 spirit of free trade enjoyed greater success in nonagricultural commerce, where most tariffs of the industrial countries have been negotiated down to low levels. Governments have bought off the ever-present interests seeking protection by managing trade through "voluntary" export restraints, international quota systems such as the Multifibre Agreement, and the like. Although the management of trade gets no respect from most economists, its consequence has been more to limit the growth of trade and distort its pattern than to raise the (static) marginal incidence of trade restrictions.

This shift toward freer trade and the generally sustained economic growth of the industrial countries have yielded (especially in the past three decades) much experience with the effects of international competition on national product markets. By these we mean the distinctive ways in which domestic sellers' competition and the market outcome are affected by the presence of foreign customers and/or sellers. In the first three sections of this paper we review theory and recent empirical evidence on the effects of international competition on the performance of domestic industries in two familiar dimensions—allocative efficiency and productive efficiency. Then we present new empirical evidence on one manifestation of international competition that only recently gained recognition, its effect on turbulence or turnover within the domestic industry.

1. International Competition: Theoretical Approaches

If international competition simply meant more rival sellers and buyers in the relevant market than in a closed economy, it would be both welcome normatively and simple analytically. For a country that is small in relation to the world economy (changes in its international excess demands have no perceptible sustained effect on world prices), its domestic producers, however few they may be, would become locked into pure competition and constrained to behave as price takers. Any international disturbance reflected in a change in the world price would cause domestic producers' output to adjust along their "competitive" supply curve representing optimal quantity responses to a parametric price change. The adjustment works the same way whether the nation is a net importer or exporter. This model is simple and decisive, but it leaves out properties vital to the operation of most product markets. We can fortify the vintage by making either of two assumptions:

A1. Transactions across national borders encounter large natural (transport, marketing) and/or artificial (tariffs, quotas) restrictions that do not impede domestic transactions.

A2. Buyers' tastes for attributes of differentiated goods are heterogeneous and might be nationally distinctive; a large fixed cost must be incurred to produce each differentiated variety of a product.

Most analytically interesting and empirically fruitful models of international competition rest on either A1 or A2.[1] We first focus on homogeneous products and employ assumption A1, which implies that trade restrictions and international transaction costs create a wide zone of insulation around the domestic price. That zone stretches from the delivered domestic price of importables down to the net price that can be realized from exports. Trade restrictions with a tariff-equivalent incidence of ten percent remain common, and studies of the specific international component of transaction costs place them at least that high; since the zone of insulation is made up of the sum of domestic and foreign tariffs and transaction costs, a span of 40 percent of the world price is quite plausible.

This potentially large zone of insulation raises the possibility that equilibrium in the domestic market depends solely on domestic cost and demand conditions, and that it reflects any imperfection due to domestic sellers being few and their mode of interaction noncompetitive. Import competition sets an upper bound on domestic price (world price plus domestic tariffs and transaction costs) and limits monopoly rents from producers' domestic sales. Export opportunities set a lower bound to domestic price (world price minus foreign tariffs and transaction costs). If domestic producers can export profitably, the domestic equilibrium price might be determined in either of two ways: it might be locked by arbitrage to the lower-bound net domestic price of exportables, or it might be set higher in the manner of the classical model of "dumping."

Assumption A2 leads to very different results from A1: the now-familiar monopolistic-competition equilibrium in international trade, in which directly competing varieties might be produced either at home or abroad and consumed in both locations. Two-way or intraindustry trade takes place, and the incremental effect of international trade on welfare involves some combination of gains in utility to consumers from the opportunity to consume more varieties and from lower prices of varieties that would be produced in a closed economy (because their producers now face competition from closer substitutes, and/or because they produce at larger scales).

Models of international competition based on A1 or A2 thus predict that international competition generally enhances allocative efficiency, i.e. reduces deadweight losses due to any noncompetitive behaviour of domestic sellers. For models based on A1 the qualitative prediction is complex, in that it depends in an interactive way on the number of domestic rivals, their cost position (absolute advantage) vis-à-vis their foreign rivals, and the size of the zone of insulation. For models based on A2 the effect of international competition is clear and simple, but the quantification of international competition becomes problematic. It depends on the incremental effect of international rivalry on the number of product varieties offered to domestic customers and consequently the elasticity of demand faced by the typical domestic (or foreign) seller: the greater the elasticity, the lower the price-cost margin.

These models also supply predictions about productive efficiency, the degree to which domestic producers produce whatever quantities they offer at the minimum attainable social cost. With scale economies or fixed costs limiting the number of sellers who can in equilibrium serve a closed domestic market, A1 models imply that tariff protection allows too many domestic producers to

[1] Here we ignore the many issues that arise when the country is "large" and can exert monopoly power or strategic leverage internationally.

occupy the market; the excess increases with the size of the zone of insulation and decreases with the aggressiveness of domestic producers' market rivalry (which limits the excess of price over minimized cost). A2 models imply that the restriction of international competition inflates the number of producers serving the domestic market and curtails their scales of operation; to the extent it does not constrict scales of operation, it reduces the number of varieties available to domestic consumers and the surplus they enjoy. Economic welfare is impaired one way or the other. If we suppose that productive inefficiency can result because utility-maximizing managers who face few rivals fail to minimize costs, both A1 and A2 models suggest that inefficiency can result where the optimal number of domestic producers is small (and, for A1 models, the zone of insulation is large).

The analytical framework that we have sketched supplies empirical predictions about how international competition improves the performance of product markets in national economies. The results from empirical testing of the resulting hypotheses can now be summarized. The effect of international competition on allocative efficiency seems to be a well-settled matter. Less familiar and fully developed are empirical investigations of international competition's effect on productive efficiency.

2. Allocative Efficiency: Empirical Findings

The early evidence on international competition and allocative efficiency was summarized in Caves (1985). A fairly clear consensus prevails on the proposition that when markets suffer deadweight losses from too little competition, the distortion results jointly from the fewness of domestic sellers, barriers that impede entrants, and absence of close competition from imports (that is, three necessary conditions). Studies of the effects of domestic producers' opportunities to export on domestic deadweight losses have reached diverse conclusions or none at all, consistent with the theoretical prediction that the outcome depends on whether dumping occurs, something that usually the researcher cannot control.

Recent research has supplemented these earlier findings principally in two ways. First, the short-term effects of changing international competition have been isolated from the long-run equilibrium effects isolated in the earlier cross-section studies. Domowitz, Hubbard, and Petersen (1986) showed the effect of increasing import competition on U.S. manufacturing industries by comparing estimates of the standard model of the determinants of allocative efficiency in cross-section year by year from 1958 to 1981. The statistical fit of this model began to deteriorate in the early 1970s, and by the latter 1970s its explanatory power had dried up. They showed that one substantial cause of this desiccation was the increased import competition faced by many of these industries. It was not the only cause, however: the havoc wreaked on patterns of stable oligopolistic conduct by the inflationary disturbances of the 1970s decade and the coincident (temporary) capture of substantial rents by trade unions were also important. These domestic factors proved transient and were reversed in the early 1980s (Salinger 1990; Caves 1992), but the effect of international competition held fast. Katics and Petersen (1994) exploited their panel data to confirm these findings about the impact of changes in import competition with concentrated domestic producers, and they showed specifically that the relationships continued to hold at least through 1986.

The second new element is to incorporate strategic interaction between oligopolistic producers in different producing countries. Yamawaki (1986) implicitly factored the profits of Japanese manufacturing industries into profits on their domestic and international sales: the domestic component was found to depend on Japan's domestic market structure in the usual way; the foreign component varied with the structural competitiveness of counterpart producers in the United States so as to suggest that Japanese exports are more profitable, the less competitive are their U.S. rivals.[2] Yamawaki and Audretsch (1988) obtained results similar to Yamawaki (1986) by means of a model which assumes that U.S. and Japanese producers are in Cournot competition with each other in each of the two national markets taken separately. Specifically, they related the Japanese share of U.S. domestic disappearance to variables indicating the relative costs and relative competitiveness of Japanese and U.S. producers, finding that the share increases with the cost and structural competitiveness of the Japanese and decreases with those variables for their U.S. rivals.[3] Yamawaki (1991) demonstrated one of the avenues by which import competition operates. One factor limiting the number of competitors able to fit into a market is a substantial fixed cost or scale economy in establishing a distribution system to handle a new producer's output. Yamawaki (1991) showed that Japanese exports to the U.S. market and investments in distribution facilities in the United States are complementary: an increase in one positively influences the level of the other.

3. Productive Efficiency: Empirical Findings

The theoretical models of international product market competition noted previously have no precise implications for productive efficiency. Indeed, economists have not made much headway formalizing the commonplace that external rivals (wherever located) limit sloth and inefficiency within the firm. The more competitive is a market, the lower are profits for an efficient firm, and the less inefficiency can persist consistent with the firm's meeting the opportunity costs of its inputs and keeping the coalition together. Recently more sophisticated models have explored the effect of market competition on the efficacy of governance contracts within the firm (see the summary in Nickell 1996), but some of these obtain positive, others negative relations between competition and efficiency. We turn to the evidence.

Important findings about international trade and productive efficiency have emerged from employing stochastic frontier production functions to estimate the gaps between average and best-practice plant productivity in individual national manufacturing industries. This line of research assumes that the plants or firms classified to a national industry employ a common technology or production function that determines the maximum output attainable for any given bundle of inputs. In statistical estimation of the output-input relationship the error term is assumed to be the sum of the usual random component and some one-sided distribution of inefficiencies, or amounts by which a randomly drawn unit's efficiency might lie below the attainable frontier. An estimate is obtained of both an industry's frontier production function and the average departure of its plants or firms from best-practice efficiency. Although this procedure for estimating productive inefficiency

[2] Pugel (1980) earlier showed that, while the rents of U.S. producers decrease with the share of the market held by competing imports, the import share also increases with the concentration of the domestic producers.

[3] They controlled for the share of U.S. domestic disappearance held by third-country exporters, finding that its statistical influence is consistent with these exports injecting (Cournot) competition additional to that due to the U.S. and Japanese producers.

is purely statistical and does not rest on an economic model of optimizing behaviour, Torii (1992) showed that it can be given a plausible economic foundation.

Caves and Associates (1992) applied this methodology to individual industries in the manufacturing sectors of six nations, testing in cross-section what structural factors influence differences among industries' efficiency levels in each country. They found that competition in general has the expected favourable effect on efficiency. In industries with few sellers efficiency increases with competition in each of the countries, although in most of them efficiency drops off in the least concentrated industries (probably associated with high rates of gross turnover of entering and exiting units). Notably, in every country efficiency increases with international competition, measured either directly by imports' share of the domestic market or inversely by the amount of protection provided by the government. These results are strongly consistent with models of international competition based on assumption A1. So far we lack direct tests of the implications of models based on A2—that gains from international competition should take the forms of larger scales or less diversified outputs of domestic production units. However, extensive research mostly on small countries with import-competing manufacturing sectors and traditionally high levels of protection, mainly Canada and Australia, has tended to show that international competition truncates the small-unit tail of an industry's size distribution of plants.

Other evidence reveals that international competition improves the cost and efficiency levels of individual firms. Consider the cadre of white-collar employees in a large firm. Although economists presume that the value-maximizing firm employs some optimal number of administrative workers, that target surely cannot be easy for the manager to identify and implement. Nonproduction employees work in teams and carry out many investment-type activities whose future cash flows defy accurate prediction (or indeed isolation ex post). Furthermore, white-collar employment is prone to inflation when departures from purely value-maximizing behaviour occur. One such departure lies in the natural dynamics of bureaucratic expansion, which cannot necessarily be kept in check even by a skilled, value-maximizing top manager without the constraint of external competitive pressure. If managers can slant the firm's input choices toward providing utility for themselves, staff perquisites and empire-building could lead to inflated white-collar staffs. To explore this dimension of productive efficiency, Caves and Krepps (1993) investigated whether the squeeze-out of white-collars workers from various U.S. industries that occurred in the 1970s and 1980s could be associated with increases in international competition. Especially in the 1980s international competition along with pressures from the market for corporate control forced significant and substantial reductions in white-collar employment. Nickell (1996) analyzed the determinants of large United Kingdom firms' productivity levels and growth rates over the period 1972-1986. After controlling for domestic competition (which clearly favours productivity), he found a marginally significant positive influence of international competition on productivity growth. It did not, however, prove robust when he switched to a larger but less complete data set.

These efficiency gains forced on individual firms by international competition should also appear as an association between industries' rates of productivity growth and changes in the growth of imports' share of the market. MacDonald (1994) related rates of productivity growth of United States manufacturing industries for three-year periods to rates of growth of imports' shares in the preceding three-year period, finding that in concentrated industries imports' lagged growth rate exerts a significant positive influence (with the industry's growth and other structural attributes

controlled). A related corollary tested by Baily and Gersbach (1995) holds that productivity differences between national branches of a given industry should reflect differences in the international competition to which they are exposed. Intensively studying nine industries in the United States, Germany, and Japan, the authors controlled (by a process that is opaque to the reader) for an extensive set of factors that might cause productivity differences: the standard neoclassical sources (including capital age, utilization, and technology) but also scale of operation, product mix, and organizational factors. New investment and efficient scales of operation are important for some industries; "innovations in manufacturing design that involve research and development and engineering" are important, but proprietary technology generally is not. Upon classifying the firms in each industry as facing either local, national, or global competition (both trade and foreign investment), they found a positive relation between the productivity position of a sector and the globalness of its competition. Causation is not demonstrated directly, but among the "laggard" country/industry cells they found the more productive ones to face more competition than the least productive; if low productivity attracted international competition, the relation would show the opposite sign.

Although models of international competition with differentiated products have not been tested directly, an indirect test appears in studies of industries' adjustments to changes in international competition. The focus falls on intraindustry trade, a predicted and confirmed correlate of monopolistic competition in international markets. The implications of intraindustry trade for productive efficiency can be seen in a domestic industry's response to increases in international competition. Caves (1990, 1991) studied how Canadian manufacturing industries adjusted to the substantial increases in international competition that took place during the 1970s. Increased world excess supplies of importables to Canada drove down Canadian prices relative to world prices, although those declines were retarded in concentrated industries and those offering differentiated products. The structural adjustments that followed did not match the model of contraction down the supply curve of a purely competitive domestic industry. Employment was reduced, but capital expenditures typically increased rather than declining, and Canadian exports showed a lagged positive response to exogenous increases in Canadian imports. This adjustment pattern matches the comparative statics predicted by models of monopolistic competition in international industries. Unfortunately, the adjustment process could not be pursued to the implied changes in plants' scales and product mixes, especially relevant for productive efficiency.

In conclusion, international competition supports productive efficiency just as clearly as it promotes allocative efficiency. Evidence confirms predictions from models based on both A1 and A2 characterizations of the underlying market structures.

4. *International Competition and the Incidence of Disturbances*

There remains a corollary of the models of international competition that has been little tested. Consider the A1 approach and its zone of insulation of the domestic price. The model implies that when the domestic price lies at neither boundary, any sufficiently small external disturbance to the world price will have no effect on the domestic price. Other things equal (in particular the frequency and scope of disturbances of domestic origin striking various domestic industries), the amounts of adjustment observed to occur in various industries should increase with the closeness of their international competition.

This prediction had its origin in a recent contribution by Forsyth (1995), who was investigating asset sales and purchases made by firms in various U.S. industries during the merger wave of 1979-1986. Her analysis, framed in the literature of corporate governance, addresses the ability of corporate-control mechanisms to force the managers of large, diversified firms to make decisions to disgorge or acquire assets in the best interest of shareholders. Her model assumes a (potential) gap between the (random) cash flow realized by a firm from a durable asset and that asset's value from sale or liquidation prior to its ultimate demise. Real synergies might warrant the firm holding a diversified group of assets. Without synergies, however, by choosing to hold several dissimilar assets managers can impair the firm's value, either because negative cash flows from a poorly performing asset drag down a profitable one enough to force bankruptcy, or because a profitable asset supports an underperforming one that should be sold off. A diversified firm therefore has a positive value exceeding the sum of its component assets' values only if the synergies from teaming the assets exceed the expected value losses in states of nature when the assets are inappropriately combined.[4]

Forsyth nominated the industry's exposure to international trade as the proxy for a factor increasing the divergence of value trends for assets held by a firm. That is, disturbances occurring solely within the U.S. economy are more likely to be correlated with each other than are disturbances of mixed domestic and international origin. She validated this assumption by showing that the year-to-year variability of U.S. industries' levels of net output increases with their exposure to international trade. Forsyth then identified mergers and acquisitions that had occurred among large firms in each narrowly defined (three-digit) U.S. manufacturing industry during1979-1986. For each acquired firm she identified asset sales that had occurred in the four years following the acquisition and regressed their normalized value on the variability of net-output charges in the firm's industry. With asset purchases by the combined firm controlled, asset sales increase with output variability which itself increases with an industry's exposure to international competition.

To summarize this mechanism, Forsyth found that trade exposure is a source of disturbances to the values of business assets and thereby a trigger for their reorganization through merger. Those changes in assets' valuations should correspond to changes in real activities of the firms owning them: favourable shocks causing businesses holding the "right" assets to expand, those with the "wrong" assets to contract. Forsyth's model thus implies that the turnover of market shares among

[4] She showed that, given the lock-in of diversified assets, separate debt contracts conditioned upon the outcomes of individual assets will not solve the problem. If two assets of initially equal values are pooled and their values move in opposite directions, the less likely are they optimally liquidated at the same time. A decrease in the covariance of the assets' cash flows increases the likelihood of either inefficient liquidation or inefficient failure to liquidate.

an industry's incumbent firms and the entry and exit of firms should also increase with trade exposure. Her empirically validated assumption that a market's exposure to international trade increases the incidence of disturbances parallels what we have called the A1 approach to modeling trade and domestic industry competition.

Before we proceed to test that hypothesis, however, its plausibility requires closer consideration. While the A1 approach implies that some markets are exposed to international disturbances while others are sheltered, the A2 approach and practical observation combine to suggest that nearly all national industries face some exposure to world markets. Do we then expect turbulence among domestic producers to increase with exposure to international markets? Two lines of reasoning could support this prediction:

1. We might assume that the variance of the typical dollar's worth of trans-national transactions is greater than that of the typical dollar's worth of domestic transactions. This assumption, which Forsyth made, can be supported by invoking the variability of the exchange rate and the caprices of governments' trade policies, which directly affect international but not domestic transactions. The a priori force of this assumption should not be oversold, however. One implication of the smallness of an open economy is that the number of domestic sellers and/or buyers regularly in the market is absolutely small. Disturbances originating with individual domestic parties then might be averaged out less fully than disturbances to comparable individual parties located abroad. Trade exposure could then actually help to reduce overall turbulence among domestic suppliers. In short, the assumption of greater variance in international transactions is plausible but not compelling.[5]

2. Implications for market turbulence and trade exposure flow from the theory and evidence previously summarized in this paper about the favourable effect of international competition on allocative and productive efficiency. Consider the national economy that is small in the sense of the A2 approach: total domestic consumption allows only a small number of differentiated varieties to be offered. The foreign market being much the larger, probabilistically the producer faces a more elastic demand in the international market. Even if domestic and foreign buyers' reservation prices for this producer's "brand" have the same variance, they will lead to larger changes in quantities where trade exposure is greater, because trade exposure increases the relative sizes of quantity responses to disturbances from either foreign or domestic sources.[6]

In short, we can predict that turbulence increases with trade exposure through either of two mechanisms: greater variance of international disturbances, or competitiveness increased in ways that raise turbulence. Each prediction rests on assumptions that are plausible but not obviously applicable to all product markets. Clearly, the empirical evidence must decide.

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[5] Davis, Haltiwanger, and Schuh (1996, pp. 47-9) assumed that no presumption exists, and they found no effect of international exposure on employment turnover in United States markets.

[6] If the A2 approach predicts that turbulence increases with international competition, the same does not necessarily follow from other models of imperfect competition. Indeed some empirical research on industrial organization suggests that international exposure could increase turbulence when it increases competition from "little" to "moderate" but reduce it when the change is from moderate to strong. See Caves and Porter (1978) and other literature on biases toward nonprice competition in moderately collusive industries.

5. International Competition and Turbulence in Canadian Manufacturing Industries

We employed primary records from Canada's census of manufactures over the period 1973 to 1992 to test the relation between an industry's exposure to trade and its incidence of mergers and other forms of industrial turbulence. This country and time period provide an attractive site. First, over these two decades trade exposure increased substantially. In five groups of Canadian manufacturing industries the rate of import penetration (imports/domestic disappearance) grew at rates varying from 1.23 to 1.60 percent annually. The importance of exports similarly increased: exports/total production increased at rates between 1.30 and 2.05 percent annually. Second, in 1987 Canadian manufacturing industries were presented with the opportunity/threat of a major reciprocal reduction in protection under the North American Free Trade Agreement (NAFTA). In 1989 Canadian producers began to lose tariff protection against other North American suppliers, at the same time they began to gain tariff-free access to (most) other North American product markets; we shall break out the period of 1989-1992 for comparison to the years that preceded it. Third, because of the existence of a longitudinal data base that tracks Canadian plants and firms over time, detailed measures can be developed of the reorganization of narrowly defined manufacturing industries through the entry and exit of firms, the growth and contraction of firms' employment levels, and the turnover of control of business units (mergers).

The relation between turbulence and trade exposure can be tested both in cross-section and over time. While we can and will integrate them in a standard analysis of panel data, the different facets of behaviour that they expose should be kept in mind. In cross-section we should observe any long-run relation between levels of turbulence and trade exposure. A positive relationship will fail to reject one or more of the mechanisms stated previously: international disturbances on average have a greater variance, or greater competitiveness due to trade exposure amplifies the turbulence that disturbances from all sources cause for domestic producers. To isolate a cross-section relation will require care in controlling for differences in industries' structures, for these could readily affect both trade exposure and turbulence. Time-series analysis allows us to compare short-run changes in turbulence and in trade exposure with industry structure held strictly constant. It will be particularly appropriate if we suspect that greater variance of disturbances in international markets may be not a constant but an occasional consequence of large shifts in exchange rates, countries' trade policies, and the like.

Measures of Turbulence

Turbulence in each Canadian manufacturing industry will be measured by merger activity (Forsyth's hypothesis) and also by shifts in firms' competitive positions within industries:

1. Entry into an industry occurs when a new plant is created in an industry by a firm (new, or established elsewhere) that previously did not possess a plant in that industry. For each year the variable is measured by the number of total employees in such new plants divided by employees in all plants of the industry.

2. Exit from an industry occurs when a plant ceases to operate and its owning firm no longer possesses any other plant in the same industry. It is measured by the number of employees in the exiting plant in its last year divided by employees in all plants in the industry at that time.

3. Gain is obtained by dividing plants each year into those that increased their employment within an industry and those that reduced it. For each year the growth in employment of those that grow is divided by total industry employment.

4. Loss is obtained by summing the decreases in employment within an industry for those plants that experienced reductions in a given year, then dividing it by total industry employment in that year.

5. Merger is defined to occur when the ownership of a plant changes, and the variable is defined as the number of plants that have changed hands in a year divided by the total number of plants in the industry.

We also make use of Entry & exit = Entry + Exit and Turnover = Gain + Loss. Note that the census measure of a plant's employment level for 1974 (say) is an average of observations taken at various times during the year. Its change from 1973 to 1974 thus summarizes changes occurring over 24 months that we can regard as centered on mid-1973 to mid-1974. The 1974 value of Gain, Loss, Entry, and Exit thus will be affected by trade exposure in both 1974 and 1973. Since some delay in response seems natural, we shall lag trade-exposure measures by one year when explaining these dependent variables (the problem does not arise with Merger).

In previous research (Baldwin 1995a: chap. 8) these measures of turbulence were found strongly and explicably related to structural characteristics of industries such as the concentration of producers, the efficient scales of plants, advertising/sales ratios, and research and development intensity. Rather than employ a group of the standard market-structure measures as controls, we made use of a classification originated by the Organisation for Economic Cooperation and Development (OECD) of manufacturing sectors into five groups: natural resource; labour intensive; scale-based; product differentiated; and science-based. The effectiveness of this schema as applied to the Canadian standard industrial classification was validated by a discriminant analysis using variables such as the wage rate, labour remuneration's proportion of value added, producer concentration, estimates of scale economies, research and development intensity, and ratios of advertising to sales (Baldwin and Rafiquzzaman 1994). In previous research (e.g., Baldwin 1995a: chap. 11) this classification proved to be a strong, parsimonious tool for controlling differences in the incidence of changes in business-unit control and the productivity of those changes - exactly the variables suited to testing Forsyth's hypothesis.

Panel and Cross-section Relationships

We began the analysis with a very simple approach based on time series. For each year we aggregated establishments to the level of the five OECD sectors and calculated each measure of turbulence at the sectoral level. We then calculated for each sector simple correlation coefficients between pairs of eighteen-year time series of turbulence and Exports + Imports. The results were encouraging. All correlations were positive and most statistically significant, especially those with

Exit, Loss, and Merger. However, we also discovered that most turbulence measures as well as trade exposure had upward trends over the period. Was trade exposure causing turbulence, or were both rising on the tide of more fundamental changes?

We shifted to a panel of 110 manufacturing industries defined at the three-digit level of Canada's standard industrial classification. In each industry the measures of turbulence and trade exposure (Imports = imports/domestic disappearance, Exports = exports/production) are available for each year 1973-1992.[7] This two-decade period is divided into three blocks—the 1973-1982 period dominated by energy shocks and inflation (hereafter 1970s), the 1982-1989 period centered on years of low inflation and unemployment (1980s), and 1989-1992 with domestic recession and trade adjusting to the North American Free Trade Agreement (1990s).

A pattern surfaced in the association between turbulence measures and trade exposure that influenced the model specifications that we report. Imports and Exports are correlated in the panel data set, so one cannot readily measure their separate effects on the measures of turbulence precisely. There is a stable pattern, however, whereby Gain and Entry are better explained by Exports, Loss and Exit by Imports, and Turnover and Merger by their sum. This is highly plausible: the losers among Canadian producers are knocked out by the superior price-quality offers of imports, while the winners claim their victories in both domestic and export markets. The reported results therefore match each turbulence measure with what is revealed to be its natural partner among measures of trade exposure.

The main conclusions from the panel data appear in Tables 1, 2, and 3, each reporting two models of the dependence of each turbulence measure on its partner measure of trade exposure. The first model is a simplified fixed-effects treatment in which the controls are dummies for four of OECD sectors (science-based omitted) and two of the three time periods (1990s omitted).[8] The second model estimates not a single slope coefficient on trade exposure but a separate one for industries classified to each OECD sector. Table 1 addresses Turnover and its components Gain and Loss. First of all, trade exposure exerts a highly significant positive influence on each turbulence measure. The OECD sectoral dummies prove their worth as controls: relative to the omitted science-based industries, the scale-based industries tend to show significant negative intercept shifts, and the product differentiated and labour intensive groups significant positive shifts. It is certainly plausible that product differentiated industries should exhibit high turnover due to product innovation and obsolescence. Labour intensive industries should also exhibit high turnover because of their low levels of sunk costs, just as heavy sunk costs and well-defined capacity limitations should dampen turnover in the scale-based sector.

In the second equation for each turbulence measure the positive overall relation is confined to the resource-based, product differentiated, and (with marginal significance) science-based OECD sectors. For the latter two the results obviously correspond to the expected effect on international

[7] Trade flows were matched comprehensively to production-related data for these industries. The trade data come from the International Trade Division, Statistics Canada.

[8] In previous research on job creation and destruction, concepts closely related to turnover as measured in this paper, Baldwin (1995a: pp. 139-147)(in collaboration with Timothy Dunne and John Haltiwanger) found that they are significantly related to import competition in Canada, although not when industry fixed effects are included. For export intensity the results are erratic. A parallel analysis for the United States also turned up a significant positive influence of import competition on job turnover that is not sensitive to industry or year fixed effects.

competition when products are differentiated. But that explanation also holds for natural resource industries, which include the food and beverage sector. Trade exposure appears to reduce Gain for scale-based industries, consistent with world market exposure actually allowing more steady utilization where sunk costs sharply demarcate capacity.

Equations (1) and (2) include time-period dummies that indicate significant and substantial upward trends through the period for Loss and Turnover. Replacing the decade dummies with individual-year dummies shows the upward trend in Turnover to be steady with minor hesitations through the whole period. What factors should account for the trend, apart from the rising trade exposure that is controlled in our analysis, is a question of great interest, especially since Davis, Haltiwanger, and Schuh (1996: Table 2.1) found no such trend for the United States. If we allow the trade-exposure variable to take a different slope coefficient in each period (not shown in the table), its effect on Turnover is not significant in the 1970s but increasingly positive and highly significant in the 1980s and 1990s. The perception, widespread in Canada and elsewhere, of increasing international competition seems to be supported.

Table 2 reports models specified identically to those in Table 1 for Entry, Exit, and their sum. This form of turbulence also shows a significant positive dependence on trade exposure. The highly significant effect on Entry & Exit flows chiefly from the surprisingly strong effect of export opportunities on the entry of new units. Since exporting tends to be concentrated among an industry's larger firms, this relation might be due to the effect of exporting opportunities on new-plant construction by large firms. The pattern of sectoral intercept shifts is similar to that in Table 1, and the upward trends over time in Exit and Entry & Exit parallel those for Turnover. The pattern of slope coefficients among the OECD sectors (equation (2)) differs, however, with the natural resources sector showing the closest linkage. Entry increases with Exports in the labour intensive industries but decreases with them in the scale-based sector (probably due to the slow growth and established export positions of Canada's wood, paper, steel, and automobile plants). Exit and Imports are related in natural resources but only weakly overall. There is not much direct relation between these variables, although the relation of Loss to Imports implies an indirect link.

Before evaluating Table 3's findings on Merger we must make an important point about its construction. Unlike the other turnover variables, Merger takes zero values in a number of industry/year cells of the data set. Probably that is because the forms of control changes identified in this data base miss many of the control changes that occur in small businesses, when individual proprietors sell or closely held corporations are reorganized. We elected therefore to analyze the relation between measured control changes and trade exposure only in those industries and years with strictly positive amounts of acquisition occurring. This procedure, while not the only plausible choice, has the advantage of alignment with Forsyth's hypothesis, which pertains to public corporations with widely traded securities.[9] With this property noted, we observe in Table 3 that changes in plants' control also depend significantly on trade exposure, confirming Forsyth's result for the United States. The intercept shifts show that control changes were particularly extensive during 1982-1989 and in the scale-based and natural resources sectors. The dependence of control changes on trade exposure, however, is apparent in the product differentiated and science-based industries. That finding is interesting because these are also the sectors in which Baldwin (1995a:

[9] Recall also that Merger is based on counts of plants, not weighted by size or value.

chap. 11) found control changes during the 1970s to be both more prevalent and more favourable in their effects on productivity in the affected business units. Exposure to international competition seems to speed the reorganization of business assets just where reorganizations on average create the most value.

Relationships Over Time

The effects of trade exposure on turbulence measured so far are obtained from fixed-effects models that are partial with respect to both industries and years. Hence, the key regression coefficients represent some mixture of cross-section effects, time-series effects, and uncontrolled systematic disturbances. Recall the two channels identified in Section 4 by which trade exposure enlarges turbulence: either it "imports" a greater variance of disturbances from abroad (the external-disturbances channel) or it inflates the turbulence-producing effect of whatever disturbances are occurring (the competitive-pressure channel). Evidence already presented supports the competitive-pressure channel by locating the effect of trade exposure in the OECD sectors most prone to product differentiation and innovation (and least tied down by sunk plant capacities). The external-disturbances channel was not specifically supported; for example, the sensitivity of turbulence measures to trade exposure was greater in the tranquil 1980s than in the 1970s, which were roiled by wide swings in countries' inflation rates and nominal and real exchange rates. Can the external-disturbances channel be isolated in time series?

Despite the richness of the underlying data, our leverage on intertemporal effects is limited. As we have seen, common upward trends exist in turbulence and trade exposure. Analysis of time series for the individual three-digit industries would face this problem while introducing a great deal of random noise. A relationship in first differences is the natural choice, but it also elevates the importance of random disturbances.

We settled on a simple approach based on a cross-section of first differences keyed to the shifts in the overall incidence of international disturbances that apparently occurred during 1973-1992. We divided the period into the same three segments used in Tables 1 through 3. The first period 1973-1982 runs from a recession year to a recession year and covers the period of inflationary disturbances that succeeded the "energy shock" caused by the Organization of Petroleum Exporting Countries. The second interval 1982-1989 embraces an expansionary economic period free from major domestic macroeconomic disturbances. The third period 1989-1992 coincides with the first part of the gradual phase-in of multilateral tariff reductions under NAFTA. Although reductions continued after 1992, it is reasonable to assume that business managers promptly set about making their long-run adjustments: the member countries' commitments were widely regarded as credible, and managers making investment decisions naturally seek to anticipate conditions prevailing over a capital project's lifetime (this anticipatory adjustment was noted in the original formation of the European Common Market).[10] In effect we are taking NAFTA as the prototype of a large international disturbance. Each trade-exposure and turbulence measure defined previously as an annual observation was summed over the years within each of the three time intervals. Changes were calculated in each industry's turbulence and trade-exposure measures from 1973-1982 to 1982-

[10] This assumption is supported by the findings of Clausing (1996) about the prompt and substantial adjustments of Canadian trade flows in response to the tariff reductions.

1989, and from 1982-1989 to 1989-1992. Correlations were calculated across industries between changes in turbulence and trade exposure from the first period to the second (reported in Table 4) and from the second to the third (reported in Table 5).

Tables 4 and 5 show that the relation between changes in turbulence and in trade exposure differed appreciably between the two pairs of time periods. Between 1973-1982 and 1982-1989 no significant relationships appear, except that changes in mergers are correlated with changes in trade flows in a pattern that is regular but below standard levels of significance. The 1970s were (for Canada, like other countries) a period of macroeconomic turmoil both at home and abroad. The variance of international disturbances decreased from the 1970s to the 1980s while the average industry's level of trade exposure went up, so it is not surprising that the 1973-1982 to 1982-1989 changes analyzed in Table 4 offer next to no support for the turbulence-trade hypothesis in general or the external-disturbance channel in particular.

In Table 5 the growth of trade associated with NAFTA's tariff changes apparently did significantly affect turbulence and industrial reorganization. The increase in gross trade exposure is positively and significantly correlated with changes in Entry & exit as well as in Exit taken separately. The association is due to changes in imports and not in exports, and the association between the growth of exports' share and Exit changes from negative for 1973-1982 to 1982-1989 to positive for 1982-1989 to 1989-1992 (though neither is significant). Changes in Merger continue positively related to the total change in trade, a result that corresponds to Forsyth's (1995) finding for the United States, but once again fall short of standard significance levels. The association between changes in trade exposure and the turnover of incumbent businesses between 1982-1989 and 1989-1992 parallels that with Entry & exit: the change in imports (and, through it, the change in total trade exposure) is strongly related to Turnover mainly through its association with Loss, echoing the pattern found in Table 1. NAFTA's implementation did increase turbulence, mainly through the obvious mechanism of inflicting share losses and exit decisions on some domestic producers.

In summary, the test based on changes in individual manufacturing industries provides only limited evidence that short-run changes in exposure to international commerce increase turbulence within a domestic industry. However, the significant associations with NAFTA's inception is consistent with the external-disturbances mechanism.[11]

One last empirical point bears on the normative significance of turbulence, considered in the next section: the various types of turbulence are related to productivity growth in the industry. Substantial productivity improvements are associated with the transfer of market share from units that are losing market share to those that are gaining; Baldwin (1996) found that over six-year periods the gainers on average start out a little less productive than those destined to lose, but they wind up 26 to 33 percent (depending on the period) more productive. Similarly, Baldwin (1995a: chap. 11) found that changes in the control of business units on average raise their productivity appreciably, and the productivity of control changes varies strongly among industries in ways that tie the gains to

[11] An intriguing parallel result was reported by Lansbury and Mayes (1996). In a panel-data analysis of productive efficiency in United Kingdom industries during the 1980s, they found that efficiency increases significantly with the sum of import and export exposures. However, when the variables were first-differenced, the sign reversed to negative, consistent with increases in trade exposure producing short-run increases in turbulence.

better use of lumpy, heterogeneous assets (especially intangibles).[12] Turnover from entry and exit is not so directly productive: Baldwin (1995a: ch. 9) shows that entrants beneficially affects productivity by causing the smaller less productive firms to exit. Nevertheless, the effect of entry is somewhat less than turnover in the continuing sector. Baldwin (1996) found that units destined to exit during a six-year period begin it one-fifth less productive than the survivors, but entrants suffer high infant mortality, and the survivors need a decade to match the productivity of continuing units (also Davis, Haltiwanger, and Schuh 1996: 52).

Causation: Turbulence and Exports

In formulating this study we saw no general reason to treat import competition and export opportunities asymmetrically: competition from foreign suppliers should, to a first approximation, affect Canadian producers the same whether it occurs in Canada or abroad. However, the traditionally import-competing status of Canadian manufacturing suggests that a particular asymmetry might be involved. Caves (1990, 1991) traced a sequence whereby reduced trade barriers in the 1970s lowered Canadian domestic prices but raised capital expenditures, induced productivity-raising reorganizations, and ultimately caused Canadian producers facing more import competition also to become more substantial exporters.

This adjustment process, the "comparative statics" behind intraindustry trade, implies that causation runs from turbulence in producers' market shares to the extent of industry exports: firms making a run for an internationally efficient scale expand at the expense of those retreating before imports' fire. And indeed, despite the general empirical symmetry between effects of Exports and Imports found in Tables 1-5, we noticed some patterns pointing to this direction of causation. Using the panel data set of Tables 1-3, we regressed Exports in each year on Turnover in the year preceding, including dummies for the OECD sectors. We obtained the coefficient (standard error) of 0.053 (0.017), significant at the 0.2 percent level. Adding time controls left the relation significant at the 1 percent level. We allowed this slope coefficient to vary among time periods, discovering that for the 1970s the coefficient increases to 0.158, thrice the magnitude for the whole period. Thus, the relation was strongest and most significant in the 1970s and trailed off through the remaining years.

We do not attempt an elaborate dissection of the apparent two-way causation between turbulence and exports, but we note a satisfying consistency in the simple evidence: The strength of the effect of lagged Turnover on Exports was greater early in our period, when a number of Canadian manufacturing industries were first graduating from purely import-competing status. The strength of the effect of lagged Exports on Turnover was greater late in the period, once that shift had occurred. Both directions of influence appear "real."

[12] This finding has been reported from United States data as well. For example, McGuckin and Nguyen (1995) observed that large plants in the food-processing industry that undergo changes in corporate control start out less productive than average (small ones begin more productive, however), and subsequently their labor-productivity growth is significantly faster than for plants continuing with no control changes.

6. *Conclusion*

In this paper we have reviewed empirical evidence on three effects of international competition on the performance of domestic industries. Two of these are familiar. First, exposure to international trade, especially import competition, tends strongly to limit domestic industries' departures from "ideal" price-cost margins, and trade restrictions correspondingly rob this discipline of its effectiveness. The second is less familiar but well supported by evidence: international competition limits the amount of productive inefficiency that is viable in domestic firms, and trade barriers again relax this pressure for efficiency.

The third effect of international competition - on turbulence within domestic industries-has only recently been detected. In this paper we report tests for the effect using primary data on the plants and firms operating within the manufacturing industries of Canada. The analysis was conducted on variations in turbulence and trade exposure within a large panel data set: 110 industries over 1973-1992. Turbulence, measured by the entry and exit of firms, the turnover among incumbents, and the frequency of changes in control of business units, pervasively increases with trade exposure after controlling (partially) for industry and time fixed effects. The only exception is that exits by domestic producers are not significantly related to import competition. The closeness of the relationship varies among broad industry groups in a way consistent with the model of international competition that rests on trade in differentiated products. We also sought to isolate (with cross-sections of first differences) a pure short-run association. None was found between the 1970s and 1980s, but the North American Free Trade Agreement in 1989 apparently provided just the disturbance needed to kick off increased turbulence.

With this effect of trade on turbulence supported empirically, we should consider its welfare significance. Unlike the effects of trade on allocative and productive efficiency, the effect on turbulence has ambiguous benefit. Consider the negative elements first. Even without invoking subjective costs to risk-averse agents, disturbances inflict costs of adjustment that would be avoided in their absence. The uncertainty surrounding irreversible investments increases with ambient disturbances, and with it the chances that projects will be undertaken that their sponsors will later regret. Other projects will, of course, exceed mean expectations, but these can be expanded when a propitious state of nature has been revealed.

Turbulence from international disturbances also has welfare benefits, best seen in the light of continuous economic change, with international disturbances serving to deliver innovations in products, services, their qualities and varieties, and in ways of doing business and organizing activities. International disturbances then serve in part as innovations whose value is not fully appropriated by their originators, and which therefore bestow net positive benefits within a country as they are picked up from external sources of origin. To avoid disturbances, then, is to pass up opportunities or to delay their seizure.

The idea that international disturbances convey benefits can be put in other ways as well. With products differentiated, a disturbance that lowers the cost of international transactions makes it possible to cover the fixed costs associated with importing or exporting product varieties not previously traded. This benefit can be regarded as simply another component of classical

equilibrium gains from trade (Romer, 1994), but given the continual appearance of commodity innovations around the world it also implies a benevolent association between trade and the turbulence of the domestic consumption set. Exporting activities are similarly linked to the expected payout of new products, practices, and varieties. Insofar as innovations' costs are fixed, and international commerce enlarges the potential market beyond the nation's boundaries, the expected return is increased to innovative activities broadly defined.

Still another benevolent link between international commerce and turbulence harks back to the ability of trade to make markets more competitive. The heart of that effect lies in making individual domestic producers face more elastic (excess) demands than they otherwise would. In addition, disturbances communicated through international commerce can also increase competition by making collusion less feasible. Several models of collusion imply that its sustainability declines with the incidence of random disturbances, and empirical evidence for Canada has indeed supported this proposition (Spence, 1978). Whether due to disrupted collusion or more directly to international disturbances, increases in turbulence (exit of low-productivity units, turnover of share to higher-productivity incumbents, and improvement in units' productivity levels through changes in control) clearly contribute to an industry's productivity level (growth). Empirical evidence was noted in the preceding section.

These cross-cutting considerations keep any prudent economist from regarding the turbulence effects of international commerce as a clear source of net welfare gains. However, they certainly undermine any belief that clear gains in national tranquility could stem from excluding the world's Cobdens from the forum of public policy or its Commodore Perry's from the nation's harbors.

Table 1. *Determinants of turnover of market shares, Canadian manufacturing industries, 1973-1992*

Exogenous variable	Gain		Loss		Turnover	
	(1)	(2)	(1)	(2)	(1)	(2)
Intercept	0.083	0.081	0.159	0.161	0.240	0.243
	(0.003)	(0.005)	(0.006)	(0.009)	(0.007)	(0.010)
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Trade intensity	0.080		10.089		0.102	
	(0.028)		(0.039)		(0.029)	
	(0.004)		(0.024)		(0.0004)	
OECD sectors:						
Natural resources	-0.003	-0.001	0.012	0.004	0.009	0.002
	(0.003)	(0.004)	(0.006)	(0.009)	(0.006)	(0.001)
	(0.332)	(0.740)	(0.044)	(0.321)	(0.165)	(0.053)
Labour intensive	0.006	0.008	0.036	0.412	0.043	0.052
	(0.003)	(0.005)	(0.006)	(0.009)	(0.006)	(0.011)
	(0.073)	(0.075)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Scale-based	-0.014	-0.006	-0.006	-0.008	-0.021	-0.015
	(0.003)	(0.005)	(0.006)	(0.009)	(0.007)	(0.010)
	(0.0001)	(0.180)	(0.297)	(0.358)	(0.002)	(0.157)
Product differentiated	0.008	0.003	0.031	0.034	0.038	0.036
	(0.003)	(0.005)	(0.006)	(0.010)	(0.007)	(0.012)
	(0.042)	(0.530)	(0.0001)	(0.0004)	(0.0001)	(0.002)
1973-1982	-0.002	-0.002	-0.075	-0.075	-0.076	-0.078
	(0.002)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)
	(0.393)	(0.380)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
1982-1989	0.003	0.003	-0.056	-0.056	-0.053	-0.054
	(0.002)	(0.002)	(0.004)	(0.004)	(0.005)	(0.005)
	(0.206)	(0.230)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Trade intensity in:						
Natural resources		0.104		0.197		0.236
		(0.035)		(0.078)		(0.046)
		(0.003)		(0.011)		(0.0001)
Labour intensive		0.087		-0.102		-0.139
		(0.078)		(0.110)		(0.082)
		(0.265)		(0.353)		(0.093)
Scale-based		-0.144		0.128		-0.016
		(0.065)		(0.073)		(0.060)
		(0.027)		(0.079)		(0.795)
Product differentiated		0.430		0.020		0.128
		(0.115)		(0.089)		(0.071)
		(0.0002)		(0.818)		(0.071)

Table 1. (cont.)

Exogenous variable	Gain		Loss		Turnover	
	(1)	(2)	(1)	(2)	(1)	(2)
Science-based		0.185		0.078		0.087
		(0.142)		(0.106)		(0.094)
		(0.190)		(0.465)		(0.352)
F	14.34	11.19	60.06	39.79	65.40	43.85
	(7,2355)	(11,2355)	(7,2355)	(11,2354)	(7,2354)	(11,2354)
Prob. Value of F	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
R^2	0.04	0.15	0.15	0.15	0.16	0.17

Note: For Gain, trade is measured by exports/production; for Loss, imports/domestic disappearance); for Turnover, sum of exports/production and imports/domestic disappearance. Standard errors appear immediately below coefficients, followed by significance probabilities (two-tail test).

Table 2. *Determinants of entry, exit, and entry and exit combined, Canadian manufacturing industries, 1973–1992*

Exogenous variable	Entry		Exit		Entry & Exit	
	(1)	(2)	(1)	(2)	(1)	(2)
Intercept	0.006	0.007	0.037	0.040	0.042	0.044
	(0.002)	(0.003)	(0.007)	(0.004)	(0.006)	(0.0006)
	(0.0005)	(0.007)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Trade intensity	0.081		0.027		0.075	
	(0.017)		(0.018)		(0.027)	
	(0.0001)		(0.124)		(0.006)	
OECD sector:						
Natural resources	0.007	0.005	0.009	0.004	0.018	0.010
	(0.002)	(0.003)	(0.002)	(0.004)	(0.004)	(0.006)
	(0.0005)	(0.058)	(0.0004)	(0.260)	(0.0001)	(0.064)
Labour intensive	0.015	0.014	0.023	0.019	0.039	0.037
	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.006)
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Scale-based	0.0001	0.006	-0.0002	-0.0003	0.001	0.005
	(0.0002)	(0.003)	(0.003)	(0.004)	(0.004)	(0.006)
	(0.953)	(0.030)	(0.930)	(0.418)	(0.790)	(0.040)
Product	0.010	0.011	0.016	0.020	0.026	0.033
differentiated	(0.002)	(0.003)	(0.003)	(0.005)	(0.004)	(0.007)
	(0.0001)	(0.001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
1973-1982	0.002	0.001	-0.025	-0.025	-0.023	-0.023
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
	(0.311)	(0.420)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
1982-1989	0.008	0.007	-0.018	-0.018	-0.009	-0.010
	(0.001)	(0.001)	(0.002)	(0.002)	(0.023)	(0.003)
	(0.0001)	(0.001)	(0.0001)	(0.0001)	(0.0004)	(0.0001)
Trade intensity in:						
Natural resources		0.052		0.122		0.182
		(0.021)		(0.035)		(0.026)
		(0.0001)		(0.0005)		(0.0001)
Labour intensive		0.120		0.031		0.064
		(0.047)		(0.050)		(0.047)
		(0.011)		(0.530)		(0.174)
Scale-based		-0.164		0.036		-0.038
		(0.039)		(0.033)		(0.034)
		(0.0001)		(0.270)		(0.261)
Product differentiated		0.017		-0.080		-0.034
		(0.069)		(0.040)		(0.040)
		(0.798)		(0.040)		(0.176)

Table 2. (cont.)

Exogenous variable	Entry		Exit		Entry & Exit	
	(1)	(2)	(1)	(2)	(1)	(2)
Science-based		0.062		-0.018		0.041
		(0.089)		(0.047)		(0.053)
		(0.464)		(0.690)		(0.442)
F	25.39	21.18	46.82	31.35	44.85	32.50
	(7,2355)	(11,2355)	(7,2355)	(11,2355)	(7,2355)	(11,2355)
Prob. value of F	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
R^2	0.07	0.09	0.12	0.12	0.12	0.13

Note: For Entry, trade is measured by exports/production; for Exit, imports/domestic disappearance; for Entry & exit, sum of exports/production and imports/domestic disappearance. Standard errors appear immediately below coefficients, followed by significance probabilities (two-tail test).

Table 3. *Determinants of proportion of establishments subject to control changes, Canadian manufacturing industries, 1973–1992*

Exogenous variable	(1)	(2)
Intercept	0.040	0.036
	(0.007)	(0.009)
	(0.0001)	(0.0002)
Trade intensity	0.075	
	(0.027)	
	(0.006)	
OECD sector:		
Natural resources	0.010	0.015
	(0.006)	(0.009)
	(0.096)	(0.099)
Labour intensive	-0.007	-0.008
	(0.006)	(0.010)
	(0.238)	(0.936)
Scale-based	0.010	0.017
	(0.006)	(0.009)
	(0.081)	(0.074)
Product differentiated	0.004	0.005
	(0.006)	(0.010)
	(0.553)	(0.657)
1973-1982	-0.008	-0.008
	(0.005)	(0.005)
	(0.111)	(0.112)
1982-1989	0.009	0.009
	(0.004)	(0.005)
	(0.063)	(0.063)
Trade intensity in:		
Natural resources		(0.064)
		(0.041)
		(0.120)
Labour intensive		0.029
		(0.088)
		(0.740)
Scale-based		0.041
		(0.060)
		(0.480)
Product differentiated		0.128
		(0.062)
		(0.040)

Table 3. (cont.)

Exogenous variable	(1)	(2)
Science-based		0.137
		(0.089)
		(0.120)
F	8.44	5.53
	(7,1715)	(7,1715)
R^2	0.033	0.035

Note: Trade intensity is measured by sum of exports/production and imports/domestic disappearance. Standard errors appear immediately below coefficients, followed by significance probabilities (two-tail test).

Table 4. *Correlations between changes in trade exposure and in industrial turbulence measures, Canadian manufacturing industries, 1973–1982 to 1982–1989*

Turbulence Measure	Imports	Exports	Imports + Exports
Entry	0.16 (0.11)	-0.03 (0.75)	0.09 (0.34)
Exit	0.11 (0.28)	-0.05 (0.58)	0.05 (0.63)
Entry & Exit	0.16 (0.11)	-0.05 (0.60)	0.08 (0.39)
Gain	-0.07 (0.47)	-0.13 (0.21)	-0.11 (0.24)
Loss	-0.04 (0.70)	0.07 (0.47)	0.01 (0.92)
Turnover	-0.01 (0.88)	-0.13 (0.19)	-0.08 (0.49)
Mergers	0.14 (0.15)	0.10 (0.32)	0.15 (0.13)

Note: Significance probabilities appear in parentheses.

Table 5. *Correlations between changes in trade exposure and industrial turbulence, Canadian manufacturing industries, 1982–1989 to 1989–1992*

Turbulence Measure	Imports	Exports	Imports + Exports
Entry	0.09 (0.35)	-0.11 (0.292)	-0.00 (0.97)
Exit	0.28 (0.004)	0.10 (0.35)	0.21 (0.03)
Entry & Exit	0.30 (0.002)	0.01 (0.85)	0.18 (0.06)
Gain	0.05 (0.59)	0.11 (0.28)	0.01 (0.88)
Loss	0.22 (0.02)	0.03 (0.75)	-0.11 (0.26)
Turnover	0.25 (0.01)	0.04 (0.67)	0.17 (0.09)
Mergers	0.10 (0.31)	0.15 (0.14)	0.14 (0.17)

Note: Significance probabilities appear in parentheses.

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